

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of the claims:**

Claim 1 (previously presented): A method for use in combination with a crystal growing apparatus for growing a monocrystalline ingot according to the Czochralski process, said crystal growing apparatus having a heated crucible containing a semiconductor melt from which the ingot is grown, said ingot being grown on a seed crystal pulled from the melt, said method comprising the steps of:

defining a temperature model representative of variations in the temperature of the melt in response to variations in power supplied to a heater for heating the melt;

generating a signal representative of an error between a target diameter of the ingot and a measured diameter of the ingot during growth;

determining a power set point for the power supplied to the heater from the temperature model as a function of the error signal and independent of a measured temperature;

adjusting the power supplied to the heater according to the power set point thereby changing the temperature of the melt to control the diameter of the ingot; and

pulling the ingot from the melt at a pull rate following a target pull rate defined by a velocity profile, said velocity profile being stored in memory and defining the target pull rate independent of the error signal.

Claim 2 (currently amended) The method of claim 1 wherein the step of adjusting the power includes ~~applying~~ calculating a pulse of power to apply to the heater, said power pulse having an amplitude greater than the steady state power ~~corresponding directly to the temperature set point.~~

Claim 3 (currently amended): The method of claim 2 wherein the step of determining the power set point includes calculating power output by the following:

$$P_1 = P_0 + G * \left[ k * \sum_{n=0}^i T_n - (k-1) * \sum_{n=0}^i T_{n-m} \right]$$

where  $P_1$  is current power,  $P_0$  is initial power,  $G$  is a conversion from temperature units to kW,  $k$  is the amplitude of the power pulse,  $T_n$  is ~~the temperature set point~~ a signal representative of an error between target diameter and measured error at time  $t = n$ ,  $T_{n-m}$  is ~~the temperature set point~~ signal representative of an error between target diameter and measured error at time  $t = n-m$  and  $m$  represents the duration of the power pulse.

Claim 4 (original): The method of claim 1 wherein the step of determining the power set point from the temperature model includes defining an input to the temperature model, said input to the temperature model including a pulse portion followed by a steady state portion.

Claim 5 (currently amended): The method of claim 4 wherein the pulse portion of the input to the temperature model has an amplitude greater than a steady state value ~~corresponding directly to the temperature set point~~.

Claim 6 (original): The method of claim 4 wherein the pulse portion of the input to the temperature model has a duration defined by:

$$t = -\tau * \ln(1 - 1/k)$$

where  $\tau$  is a time constant of an exponential function defining the temperature model and  $k$  represents the amplitude of the pulse portion of the input to the temperature model.

Claim 7 (original): The method of claim 1 wherein the step of defining the temperature model includes defining a delay period, gain and first-order lag function response.

Claim 8 (original): The method of claim 7 wherein the step of defining the temperature model includes defining the first-order lag function response by an exponential function of time as follows:

$$f(t) = k * (1 - \exp(-(t - t_d)/\tau))$$

where  $t_d$  is the delay period occurring prior to the first-order lag function response,  $\tau$  is a time constant of the function and  $k$  represents the amplitude of a power input to the temperature model.

Claim 9 (previously presented): The method of claim 1 further comprising the step of varying the rate at which the ingot is pulled from the melt to control diameter of the ingot, said step of varying the pull rate occurring during growth of a first portion of the ingot and said step of pulling the ingot at the target pull rate substantially following the velocity profile occurring during growth of a second portion of the ingot.

Claim 10 (original): The method of claim 1 wherein the step of defining the temperature model includes measuring changes in the temperature of the melt in response to changes in the power supplied to the heater.

Claims 11-18 (canceled).

Claim 19 (previously presented): The method of claim 1 further including performing proportional-integral-derivative (PID) control on the error signal and generating a temperature set point as a function thereof, and wherein the power set point for the power supplied to the heater

is determined from the temperature model as a function of the temperature set point generated by the PID control.

Claim 20 (new): A method for use in combination with a crystal growing apparatus for growing a monocrystalline ingot according to the Czochralski process, said crystal growing apparatus having a heated crucible containing a semiconductor melt from which the ingot is grown, said ingot being grown on a seed crystal pulled from the melt, said method comprising the steps of:

- defining a temperature model representative of variations in the temperature of the melt in response to variations in power supplied to a heater for heating the melt;

- generating a signal representative of an error between a target diameter of the ingot and a measured diameter of the ingot during growth;

- determining power to apply to the heater from the temperature model as a function of the error signal and independent of a measured temperature, said determined power having an amplitude greater than a steady state value;

- adjusting the power applied to the heater according to the determined power thereby changing the temperature of the melt to control the diameter of the ingot; and

- pulling the ingot from the melt at a pull rate following a target pull rate defined by a velocity profile, said velocity profile being stored in memory and defining the target pull rate independent of the error signal.

Claim 21 (new) The method of claim 20 wherein determining power to apply to the heater includes calculating a pulse of power to apply to the heater, said pulse of power having an amplitude greater than the steady state power.

Claim 22 (new): The method of claim 21 wherein determining power to apply to the heater further includes calculating power output by the following:

$$P_1 = P_0 + G * \left[ k * \sum_{n=0}^i T_n - (k-1) * \sum_{n=0}^i T_{n-m} \right]$$

where  $P_1$  is current power,  $P_0$  is initial power,  $G$  is a conversion from temperature units to kW,  $k$  is the amplitude of the power pulse,  $T_n$  is a signal representative of an error between target diameter and measured error at time  $t = n$ ,  $T_{n-m}$  is the signal representative of an error between target diameter and measured error at time  $t = n-m$  and  $m$  represents the duration of the power pulse.